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Cover Photo by Malak: A Miner Moves Cars of Ore to Shaft.

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PROBLEMS OF SILICOSIS *in British Columbia*

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British Columbia is one of the oldest mining provinces in Canada. Its mines have been active for more than 100 years. Even under present semi-depressed metal-price conditions applying to most of its mineral production, mining continues to rank as the second basic industry in British Columbia, with annual production valued at 150 million dollars or more. Underground mining has been carried on continuously in several areas of the province for periods of 60 years and more. As one consequence, and in common with the provinces of Ontario and Quebec, there was a substantial incidence of silicosis among hardrock miners (and to a lesser degree among coal miners) many years before this disease was officially recognized.

In Ontario, where some 11,000 men were employed in the mining industry at the time, silicosis was made compensable in 1926. It was not, however, until 10 years later, with a total of 14,179 employed in all phases of the mining industry (1926 total was 14,172), that silicosis was made compensable under the industrial diseases schedule of the British Columbia Workmen's Compensation Act. As we shall suggest later, this 10-year delay in official recognition of silicosis may have been an important contributory factor in our present problems.

The Financial Problem

Examination of Workmen's Compensation Board statistics covering the financial operations of class 2/4 (Silicosis — Metal Mining) indicates that during the period 1936 to 1958 inclusive, a total of 798 claims for silicosis compensation have been accepted. Total cost of these claims has been $10,542,666.04. Annual assessments against the mining industry in British Columbia have ranged from a commencing low of $115,000 in 1936 to $684,000 in 1957 and $667,000 in 1958. While statistics for 1959 are not yet available, it has been estimated that silicosis will have cost the mining industry well in excess of $800,000 during the past year. Obviously, such costs are a matter of grave concern to an industry presently employing only about 6,000 men in its lode and coal mines and concentrators.

At the end of 1959, there were 354 pensions being paid, with 179 cases of stage one, and eight cases of stage two silicosis in suspense. This represents over 44% of the total accepted claims since 1936.

Recent tabulations suggest that the financial problems of silicosis compensation are closely linked with legislative changes and the economic well-being of the mineral industries during a given period. The tables covering the period 1936 to 1958 can be divided into the subperiods 1936 to 1941; 1942 to 1950; 1951 to 1958; 1959 onward.

The first period reflects the introduction of legislation to provide compensation for silicosis, with an initially low but rapidly rising number of accepted claims. During the first period, (and for that matter during the first 10 years of silicosis compensation) the fund was unduly taxed by the accumulation of cases from the precompensation years. The initial rate of 2.50 ($2.50 per $100 of dust-exposed payroll) was maintained for only two years, being doubled thereafter from the remainder of the period. The second subperiod began with a further 25% boost in rate to 6.25%. It will also be noted that the numbers of men employed showed only minor variation until 1942 when the impact of the war years was felt. While assessable payrolls

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remained fairly constant, assessments to meet pension requirements almost quadrupled by the end of the period, proportionately increasing the burden on the industry.

The effect of postwar acceleration of mining activity arising from increased metal prices and demand is shown in the second subperiod, 1942-51, during which the number of employees increased from a low of 6,700 to almost 11,000, providing a much broader base for assessment. In consequence the rate was reduced from a high of 6.25 to 3.25, and to 3.00 in 1952. During this period both costs and the number of accepted claims tended to decrease.

During the third of these arbitrarily designated periods, from 1951 to 1958, the tabulation of numbers employed shows the sharp decline from more than 11,000 to 5,400. Falling base metal prices and the rapid erosion of the coal mining industry owing to competition from oil and natural gas combined to reduce the numbers employed to the lowest levels in a quarter of a century.

Concurrently, amendments to Workmen's Compensation legislation substantially increased and broadened benefits and thereby compensation costs as the social service concepts of compensation gained ascendency over the insurance concept. The greatly reduced payrolls available for assessment to meet rapidly mounting pension costs inevitably forced up the assessment rates from a comparatively low figure of 3.00% in 1952 to 4.50 in 1956 and 5.62 in 1958. Even this rate of 5.62, highest since 1947, was not sufficient to meet demands on the class 2/4 fund, and the rate was increased to 7.00 in 1959.

During the past year the number employed was approximately 5,500. It is not considered likely that this will increase much beyond the 6,000 mark during 1960. Silicosis compensation costs are apparently still increasing, and there is therefore little if any prospect of a reduction from the 7.00 rate in the immediate future.

The gravity of the problem becomes even more apparent when the total compensation cost for the mining industry is considered. The rate of 7% applies to all dust-exposed personnel. Added to this is a class 4/11 (Accident — Metal Mining) rate of 4¼% which makes an aggregate compensation assessment of $11.25 per $100 of dust-exposed payroll in this province. It has been repeatedly emphasized by this Association that these levies against the mining industry are exerting a strong influence against the flow of venture and investment capital into British Columbia so vital to the maintenance and development of this industry.

As will be noted in more detail later, the mining industry in British Columbia has achieved a substantial measure of success in its efforts to improve ventilation and suppress dust. Most unfortunately, adequate statistical evidence as to the incidence of new cases of silicosis, date of first exposure to dust, and duration of exposure are not available. This is a situation which should be remedied without delay. Examination of a large number of case histories suggests that (with only one or two exceptions) virtually all claims granted have been to claimants whose first exposure to dust was prior to the introduction of silicosis compensation in 1936, and prior to the intensified dust control and ventilation programs of the past 20 years. The mining industry and the Compensation Board are cautiously hopeful that the experience in Ontario as set forth in Dr. Paterson's recent report (Ontario Department of Mines Bulletin 158, *Silicosis in Hardrock Miners in Ontario*) may be repeated in British Columbia, subject perhaps to the effects of the 10-year delay in recognition previously mentioned. If we can tentatively accept for British Columbia his Ontario statistics showing average duration of exposure of almost 23 years; average age of first recognition of almost 63 years; and increase in life expectancy of silicotic miners since 1926 by more than 20 years then the inference may be drawn that dust control and ventilation combined with certain other factors have materially reduced both the incidence and the severity of silicosis. We can only hope that this is indeed the case.

There is compelling evidence to suggest that mining companies operating at the present time have been forced through circumstances beyond their control to assume a disproportionate share of the burden of both silicosis prevention and silicosis compensation. Certainly, many of the case histories of silicotics previously and currently being compensated in British Columbia show that these men were "dusted" in the employ of companies that have long since ceased to exist and, in many instances such companies made no contribution to the silicosis fund. Additionally our records show that virtually all silicosis pensioners were dust-exposed prior to the introduction of legislation providing for silicosis compensation. It is indeed ironic and inequitable that mining companies now starting operations should be required to assume the responsibility of compensating former employees of companies that ceased to exist more than a quarter of a century ago.

As previously noted, this burden becomes even more difficult during periods of reduced mining activity when the numbers of operating companies and the assessable payrolls are curtailed, as has been the case in recent years. At the same time, these companies are properly required to maintain and increase their efforts to improve ventilation

and to suppress dust in working places. The statistics indicate, of course, that a good part of the heavy and necessary expenditures for these purposes will represent a substantial economic benefit to the mining companies of 20 years from now. In short, the mining companies of today are compelled to accept responsibility for the sins and omissions of past generations and concurrently to ensure that future generations may reap the benefits of good mining practices, good ventilation and preventive measures.

Our Association is of the opinion that it is both feasible and desirable to provide some measure of financial relief to presently existing mining companies. While we have not yet reached any definite conclusions as to the best method of achieving this objective, there are several ways in which this can be done including that of relieving them of financial responsibility for silicosis cases they did not create or which were created prior to introduction of compensation legislation. Another possibility which has attracted some support is that annual assessments should be reduced (perhaps by as much as 50%) below the actual cost of providing pensions during a given year and that the pension costs should be amortized over a much longer period. This assumes and it is fully expected that the incidence of new cases during the next 20 years will decline sharply. Existing companies will thus obtain some immediate relief from their present heavy burden. It is realized that companies yet unborn will have to accept part of this spread but we do not consider it in any way unrealistic or inequitable to suggest that part of the burden of compensating silicotics created 25 or 30 years ago should be passed on, subject to the application of sound actuarial advice. Another definite benefit of this proposal would be to offset to some extent the adverse effects of periods of curtailed mining activity and reduced payrolls available for assessment.

The Social Service Problem

In many respects the underlying insurance principle of workmen's compensation is giving way to the social service concept that compensation should be paid regardless of the circumstances. Nowhere is this trend more obvious than in compensation for silicosis. Perhaps this is more markedly so in British Columbia than in other provinces. From introduction of silicosis compensation in 1936, efforts to broaden the scope of legislation and to increase the discretionary powers of administrators have been unremitting and perhaps all too successful.

In a brief presented to members of the Government of British Columbia last year by our Association it was stated that: "While the fibrotic condition to be found in virtually all mine workers is in most cases neither of a disabling nor of an incapacitating nature, and while the lessened capacity for work is in most cases the normal product of advancing years, or the result of unrelated disease, a literal interpretation of Section 8 (5) (the section in the B.C. Workmen's Compensation Act defining silicosis) could offer the ultimate 'reductio ad absurdum' in Workmen's Compensation: Every person who has at any time worked at a dust-exposed occupation in the mining industry of British Columbia, and for whatever reason is able to demonstrate a lessened capacity for work will be able to claim, and presumably will be able to obtain, a silicosis pension."

The definition of silicosis just referred to is identical to, or very similar to, the definition in the Ontario and other Acts. Additionally there appears in the British Columbia Act a discretionary provision which we commonly refer to as the escape clause and which reads in part: "But this provision shall not prevent an allowance by the Board of any case due to silicosis that the Board considers should in justice be allowed."

It is of some interest to note at this point that during 1958, 18 silicosis claims were paid to claimants over 65 years of age; five were paid to claimants over 70; one was paid to a claimant over 75; one was paid to a claimant over 82.

Our contention is that many of these claims were paid without proper consideration of the extent, if any, of disability or lessened capacity for work attributable to silicosis, and that many of them were, in fact, paid as a form of supplementary social service benefit.

Recent experience offers some interesting evidence that uncomplicated silicosis is not by any means as deadly or as serious as once thought, and unless complicated by some infectious or other chest condition has little effect even where shown to a marked degree by x-ray. It seems that there is little or no effect on longevity and in fact, perhaps attributable to extra care, those with silicosis may live longer than the average person. Recent experience in British Columbia points up the lack of effect on longevity. Due to shut-down of one of the older and larger mines, men were laid off and applied for silicosis pensions. In many instances these men had been doing relatively heavy work, such as timbering, blacksmithing, etc., and continued to do so well past the age of 60 (and one up to 75) although examinations after receipt of their applications showed that they were suffering from a marked degree of silicosis. In one case (not in mining) a workman with marked silicosis at age 91 made a claim because in the previous two years his

earnings had decreased due to his inability to work full time.

Perhaps research should now be done to determine in the light of recent and present experience the effect of (a) slight, (b) moderate, and (c) marked degrees of silicosis in relation to ability to do (a) heavy work (b) light work (c) other activities. It may be that rules and regulations should be laid down by each province so that Compensation Boards could be consistent in their awards.

It is by no means our intention to convey that the Workmen's Compensation Board in our province is any more or less impartial and capable than those of other provinces. We believe that the B.C. Board has performed its duties well in accordance with existing legislation. Unfortunately it is becoming increasingly apparent that certain segments of the public are unwilling to accept the Board's findings. With increasing frequency, the Board's decisions are being challenged in the courts, questioned by politicians, rejected by union leaders, and made the subject of hysterical headlines in the newspapers. As an aside, it is of interest to note that the medical profession is by no means immune from these evidences of partiality and antagonism. From our own experiences we can concur entirely with Dr. Paterson in his remarks pertaining to "Problems in Diagnosis as they are Related to Compensation." It is not encouraging to read in the newspapers that a member of the profession, whether specialist or self-styled specialist, has publicly challenged the findings of the Board's specialists and referees; has determined that his patient has silicosis, and states that the patient is therefore entitled to a pension. To us this appears to be a usurpation of the authority of both the Board's medical staff and of the Board itself. We are strongly of the opinion that in so far as is possible, the impartiality and competence of the Board and its staff should not be subjected to public or legal challenges of this nature.

Perhaps the most serious social service aspect of silicosis compensation is that arising from the problems of tuberculosilicosis. Attention was focussed on this problem during a Royal Commission in 1951-52. Our Association at that time stated that in its opinion a claimant otherwise qualified to receive silicosis pension should not be deprived of that pension because the otherwise compensable silicosis in his case had become complicated by tuberculosis. Amendment of legislation followed. As one result of the interpretation placed on this change in legislation, it now appears that any claimant having any degree of silicosis almost automatically receives a pension where tuberculosis is contracted. This interpretation, which we are unofficially advised is somewhat similar to the procedure followed in South Africa, places what we consider to be an unjustified responsibility on the mining industry.

A claimant may have spent only a short period of time in a dust-exposed occupation and during that period may have developed only a minimum case of silicosis with no or virtually no disability or lessened capacity for work. He may then have left the mining industry and worked elsewhere for a quarter of a century. If he develops tuberculosilicosis he becomes a direct responsibility of the industry for cost of medical aid, hospitalization and loss of earnings. By comparison, a person employed in any other industry or occupation who develops tuberculosis and is not subject to compensation becomes entitled to medical aid, hospitalization and social assistance if he is otherwise not able to pay. The government assumes its responsibility for the treatment, care and financial support of tuberculosis victims, provided they are not dust-exposed miners.

We suggest that the problems of the tuberculosilicotic miner is a problem to be shared by the industry and the government. Steps should be taken to relieve the industry of at least a part of its responsibility in this direction.

Mining companies are acutely aware of the threat to silicotic employees who are exposed to tuberculosis. Statistics confirm, however, that much work remains to be done to ensure as far as is possible that silicosis cases are not placed in contact with active tuberculosis cases. Obviously the industry is not able to control the activities of silicotics who have left its employ, but some system of control and checking might be possible in all cases where applications for a pension has been made. It seems equally or even more important that all persons resident in mining areas should submit at regular intervals to chest x-ray and, subject to medical opinion, that tuberculin testing of all mine employees should be initiated.

The Problem of the Migratory Miner

For a variety of reasons, workmen in the mining industry move from one area to another more frequently than is the case with most other occupations. Many examples come to mind. Large numbers of miners and mine workmen were brought to Canada from Europe about 10 years ago. There were large movements of mineworkers from eastern Canada to the Alcan projects at Kitimat and Kemano. Miners from all parts of Canada moved to the uranium fields at Beaverlodge and in greater numbers to the Blind River-Elliott Lake operations. A substantial movement to Manitoba may be expected with the opening of the Thompson and Chisel Lake properties. It has been suggested, and we believe with merit, that these continuing shifts

of mining population make silicosis a national problem rather than a local or provincial problem. The only organization of which we are aware that gives consideration to silicosis on a national basis is the McIntyre Research Foundation, which by its nature is not designed to give full attention to many of the legislative and administrative problems of silicosis.

In recent years some efforts, largely unsuccessful, have been made to initiate discussions of silicosis problems on a national, or at least an interprovincial, basis. We believe this approach offers the only realistic means of confronting and eventually solving some of our problems. The following observations are indicative of the thinking of our Association on this matter.

There should be a much greater similarity of legislation throughout Canada with respect to silicosis. The present Workmen's Compensation Acts in the respective provinces now have material differences. If otherwise qualified, a miner who has moved from one province to another should not lose any part of his entitlement to compensation for silicosis. At present the provisions for qualification differ widely. The period of residence required by the different statutes varies from no specific period to five years. In order to qualify the workman must be exposed to dust containing silica for a period aggregating two years preceding his disablement in some provinces and up to five years in others. There is a time limitation within which an application must be made which varies in the different provinces, and in at least one there is discretion in the Board to extend the time for application for an unlimited period and this discretion is widely used. Similarity of legislation would not only be of value to the workman, but would be of value to the employees and all concerned interprovincially. The same applies to rules, regulations and requirements.

Since a miner may have exposure in several provinces, or may have had exposure in other countries prior to entry to Canada, there should be similarity of requirements in all of the provinces as to pre-employment medical examination and annual examination. Such pre-employment and annual examination should include x-ray and should result in issue or refusal of a certificate of fitness for underground or other work where there may be exposure to dust. A central registry could conceivably be established for maintaining records and distributing information as to the status of miners moving from one province to another.

There should be similar and strongly enforced regulations and inspection of dust conditions, and permissible dust counts should be consistent even though the actual dust count is not necessarily the aim.

In some provinces, an award for silicosis will be prorated on the length of exposure of the workman in that province in relation to the length of his exposure elsewhere. It can and does happen that a workman otherwise entitled to a 100% disability pension may receive a meager sum insufficient for the care of himself and his family. This is not only unfair to the workman, but leads to dissatisfaction in the minds of the general public who do not understand the principles of Workmen's Compensation. On the other hand, in those provinces where the full amount, irrespective of where the exposure may have taken place, is paid, the mining industry in such provinces is paying more than should be required. The employers there are unfairly burdened with a risk and with loss contrary to the principles of Workmen's Compensation.

It is suggested that interprovincial consideration should be given to the following:

(a) That provinces prorate the cost of silicosis claims in accordance with the exposure of the silicotic in each province. This step, of course, would require establishment of similar qualifications for pensions.

(b) That the province where the claimant was last employed should accept a valid claim and seek reimbursement from the other compensation boards concerned.

(c) That the time limit for making claims be abandoned since it is long since established that the effect of silicosis is generally long delayed (i.e., after 15 to 20 years exposure). As a qualification to this suggestion, adequate employment records would be required.

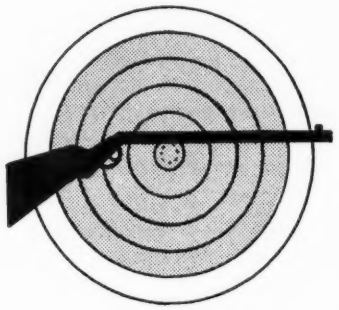
(d) That the qualifying employment period in all provinces should be made uniform (perhaps two years), if indeed a time limit is essential except for those who have been exposed to dust outside of Canada.

There are, of course, many other serious problems pertaining to silicosis and its compensation. I would suggest, however, that the problems of the migratory miner, pointing up as they do the urgent need for interprovincial cooperation; the problems arising from the social service aspects of silicosis compensation, and the serious financial problems attendant on compensation costs are of a more than ordinarily urgent nature.

We, in British Columbia, do not claim to have very many of the answers. In fact we tend to look for information and advice to the larger mining provinces and Ontario in particular. We are willing to extend our fullest cooperation to any and all efforts that may overcome these problems, which we believe can be solved through the continuing efforts of all agencies and individuals concerned.

SURVEY

OF LEAD HAZARDS IN INDOOR FIRING RANGES



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Introduction

Airborne lead in firing ranges is generated in three ways: by combustion of the lead compounds usually found in priming compositions, by abrasion of the bullet when it leaves the gun (an amount which varies with gun condition and alignment of cylinders), and by fragmentation of the bullet when it strikes the target or backstop.[1, 2] Two lead poisoning incidents have been reported in the literature,[3, 4] one in a city police practice range, the other in a shooting gallery. Recent articles,[1, 5] have called attention to the hazard in such ranges under conditions of poor ventilation.

Early in 1957 an instructor at an Ottawa firing range was found to be suffering from lead poisoning. This condition was discovered by chance when the instructor was turned down as a blood donor at a transfusion unit and referred by them to his physician for further investigation. A urine sample examined at that time was found to contain 1000 micrograms of lead per liter, about seven times what some authorities consider to be the threshold limit. A qualitative test on this sample also revealed the presence of coproporphyrin, another diagnostic sign in lead poisoning.

A urine sample from a second instructor in this range was then obtained and was found to contain 200 micrograms of lead per liter and a coproporphyrin test was strongly positive.

As a result of these findings an environmental survey of this range was carried out. The survey consisted of the measurement of air concentrations of lead during firing practice, analysis of settled dust samples for lead, and ventilation measurements. Airborne lead concentrations were found to be many times the amount recommended as acceptable for continuous industrial exposure, settled dust samples to have a substantial lead content and ventilation to be substandard.

Specific corrective measures were recommended to reduce lead exposure at this range and because of the very high airborne lead concentrations found it was also recommended that the survey be extended to other ranges. Over the past two years environmental studies of the lead hazard have been made at six ranges in different parts of Canada. In addition to these environmental studies, arrangements were made during the winter of 1958-59 to have urine samples submitted at monthly intervals from a few individuals firing regularly at each of the above and two additional ranges. These samples were analyzed for lead content only.

About one hundred air samples and one hundred and thirty urine samples were analyzed for lead. Lead-in-air concentrations measured were generally high, indicating a significant hazard to instructors and other personnel who are in the ranges for more than brief intervals. The lead content of urine samples was generally quite low, except for men working almost full time in the ranges.

Description of Firing Ranges

The firing ranges surveyed varied in length from 80 to 126 feet, in width from 20 to 36 feet and in height from 7½ to 12 feet. Five were located in basements; one on the top floor of a building which had been designed as a parking garage. Three had walls and ceilings covered with acoustical tile for

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noise control. All had some form of mechanical supply and/or exhaust ventilation.

Each range was equipped for simultaneous firing by four to eight men with rifles or revolvers. The revolvers used were .38 special or .22 calibre; the rifles, .22 calibre. The ammunition used with the .38 revolvers was known as .38 wadcutters.

For revolver practice the men stood in cubicles or at a table 20 yards from the target line. For rifle practice, the shooting was from a prone position 25 yards from the targets. Metal backstops were used at all ranges and spent shot usually fell into sandboxes. At one range the backstop was covered with a plywood shield. The targets in all cases were supported on an overhead wire and could be reeled in for inspection.

Three of the ranges were used for instructional purposes primarily and these had instructors on duty either full or a substantial part of the time. The other ranges were in intermittent use. Annual ammunition consumption at one training range amounted to 30,000 rounds of .38 calibre ammunition and 70,000 rounds of .22 calibre ammunition.

Survey Procedure

Two air sampling instruments were used during the survey, the Mine Safety Appliances Company electrostatic sampler and the Millipore Filter Corporation aerosol sampler. Both of these instruments are established as efficient air sampling devices for the collection of dust and fume. The electrostatic sampler samples air at the rate of 3 cfm and any particulate lead in the air is deposited on the inside of aluminum tubes 1½ inches in diameter. With the Millipore Filter apparatus the airborne particulates are deposited directly on the filter material. We used filters 2 inches in diameter and sampled air with this appartus at a rate of 5-10 liters per minute. The Millipore Filter apparatus was found to be much more convenient to use.

Air samples were collected during various firing procedures and with different types of weapons and ammunition. All samples were collected at breathing level, many beside men while they were firing, others where the men gather for instructional purposes, a few in the target end of the range, and some in areas adjoining ranges. A number of samples were collected before and after firing activity. Collection of air samples is illustrated in Figure 1.

Settled dust samples were collected in one range only, as it was felt that this information was of limited utility. Airflow measurements were made with an Alnor swinging-vane anemometer at air supply and exhaust grilles and doorways.

Urine samples, about 200 ml each, were submitted in specially prepared polyethylene bottles, and it was requested that the samples be collected off the range on the first Friday of each month. Individuals were asked also to report the number of hours they spent in the ranges during the previous week and month and to state how much ammunition was consumed by themselves and their associates during those periods.

Lead analyses of air samples were made by a polarographic technique; urine samples were analyzed by a modification of one of the dithizone methods.

The First Environmental Survey

The initial range surveyed, in which the poisoning incident to which reference was made took place, was located in the sub-basement of a large office building. Its dimensions were 90 x 25 x 10 feet and there was a single entrance door leading to a corridor. Figure 2 shows a plan view of this range.

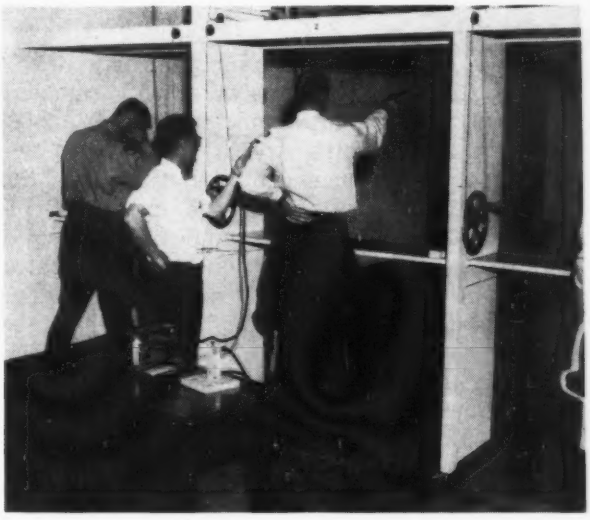


FIGURE 1. Collection of air sample with Millipore filter appartus during firing practice. Man at the extreme left is placing cotton wad in his ear for protection against noise.

This was a training range employing two full-time instructors. When not actually instructing in the range these two men worked at desks which were located just outside the entrance door.

Th range was equipped with both supply and exhaust ventilation. At the time of the survey the exhaust volume amounted to 3500 cfm, the supply volume 2300 cfm. At the time of the poisoning incident, it was reported that the exhaust system had been partly closed off. With the exhaust system closed off to simulate these conditions, a very definite outward movement of air was noted through the door into the corridor.

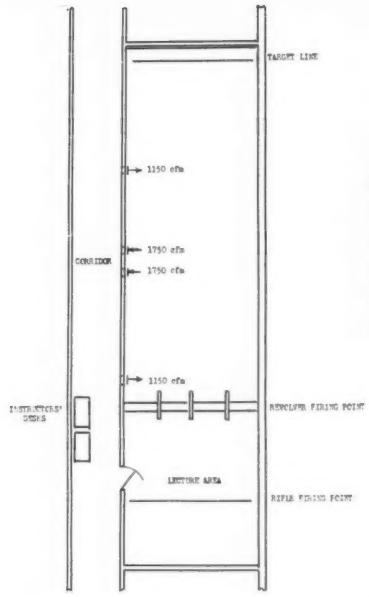


FIGURE 2. Plan of firing range where poisoning incident occurred.

Four sets of simultaneous air samples were collected. Three of these were taken with samplers located at the firing line and at the target line before firing, during firing with the ventilation system in full operation and during firing with the ventilation system as it was at the time of the poisoning incident. One pair of samples was collected after firing had ceased, with one sampler located in the centre of the range and the other at the instructor's desk in the corridor. Results of these tests are shown in Table 1.

This series of tests revealed concentrations of lead 5 to 24 times the maximum acceptable concentration of 0.2 mg per cubic meter. High concentrations were recorded during firing both with the ventilation on full and as it was at the time of the poisoning incident. It had been suspected that samples might have been contaminated by large fragments of lead formed when the bullets struck the metal backstop. However, a very substantial lead concentration was found in the centre of the range after firing — some 35 times the maximum acceptable concentration and a lead concentration of over four times the threshold limit after firing in the vicinity of the instructor's desk. Also, air concentrations of lead near the backstop were not much different from those at the firing point.

Three settled dust samples were collected during this survey and analyzed for lead content. A sample collected from a pipe over the desk of one of the instructors in the corridor was found to contain 12.5% lead. A sample from the top of a cupboard in the range was found to contain 25% lead; a sample from one of the exhaust inlet grilles contained 17.5% lead. The high lead concentration in the dust from the exhaust grille was evidence that some lead was finding its way back into the general ventilation system of the building and being distributed to other areas.

As a result of the above findings it was recommended that the air supply and exhaust volumes be increased, that air supply inlets be relocated and that the connection between the exhaust system and the general ventilation system be severed.

Surveys of Other Training Ranges

The second range surveyed was also a training range. Sixteen air samples were collected for lead determination; eight during the course of a normal training session, and eight during a special test which was arranged to measure the relative contamination at target and firing locations with and without exhaust fans in operation. The range differed from the first one in that the ceiling height was somewhat lower and the ventilation was somewhat inferior. It was ventilated by two wall-mounted exhaust fans which had a combined free air capacity of about 3000 cfm but no provision had been made for air supply and the entry door to the range had to be closed during firing because of the noise, so that ventilation was substantially reduced. Air concentrations of lead are shown in Table II. This series of tests again showed very substantial concentrations of lead during firing activity and after firing had ceased.

Shortly after this range was surveyed an instructor at one of the other ranges had a urine sample analyzed at a local hospital and was reported to be

TABLE I

Air Analysis for Lead—Range I

Firing activity	Airborne lead—mg per M^3				Ventilation
	Firing point	Target line	Centre of range	Desk in corridor	
None for 10 minutes before sample collected.	0.11	0.09			On full
Four men fired 20 rounds each with 38 revolvers	1.0	4.7			On full
Four men fired 20 rounds each with .38 revolvers	4.2	.1			Restricted to conditions during poisoning incident
No firing for 6 minutes before sample started.			6.9	0.85	As above

excreting lead at the rate of 450 micrograms per liter. A more extensive air analysis survey was carried out at this range and some 40 air samples were collected under various conditions of firing and other activities. This data is summarized in Table III.

TABLE II

Air Analysis for Lead—Range 2

No. samples	Firing activity	Airborne lead— mg per M^3			Ventilation
		Firing point	Target line	Instructor's desk	
2	Four men fired 100 rds each with .38 revolvers	14.5 & 14.9			On
1	None—break period			4.1	On
2	Four men firing steadily with .38 revolvers	14.3 & 18.5		17.0	On
1	None. Sample started 5 mins. after firing ceased			1.4	On
2 simultaneous	Two men fired 50 rounds each with .38 revolvers	7.0	8.0		On
"	None. Sample started 2 min. after firing ceased	3.8	2.2		On
"	Two men fired 50 rds. each with .38 revolvers	12.1	14.8		Off
"	None. Sample started 2 mins. after firing ceased	13.4	19.0		Off

Again very substantial concentrations of lead were recorded in the breathing zone of men engaged in firing. The data appeared to indicate a considerable variation in the lead output under different conditions of firing, most severe concentrations being recorded with .38 revolvers, lower concentrations with .22 revolvers and the lowest with .22 rifles. Also of interest in this series was the substantial contamination of an adjoining shop.

Surveys of Practice Ranges

Three ranges which were used primarily for practice firing rather than for instructional purposes

TABLE III

Summary of Airborne Lead Concentrations—Range 3*

Operation	No. of samples	Airborne lead		Average divided by M.A.C.
		Range of values	Average	
Firing .22 rifles	6	0.042–0.22	0.11	0.55
Firing .22 revolvers	10	1.0–7.2	2.56	12.8
Firing .38 revolvers (training rate of fire)	6	0.54–30	18.4	90
Firing .38 revolvers (CPC rate of fire)	3	27–63	48	240
In armourer's shop adjoining range while firing .38 revolvers at training rate of fire	6	0.22–0.79	0.31	1.55
Sweeping floor	2	0.66 & 1.6		
Before firing commenced in morning	3	.008–.011		

*Canadian Police College

TABLE IV

Airborne Lead Concentrations—Ranges 4–6

No. samples	Range	Operation	Airborne lead mg per M^3		Ventilation
			Range of values	Average	
4	4	During firing	1.8–9.2	5.4	Off
5	4	During firing	1.8–3.6	2.7	On
2	4	After firing	29.1 & 6.9		Off
2	4	After firing	0.46 & 0.51		On
6	5	During firing	0.6–20.4	5.4	On
2	5	During firing	3.7 & 2.9		Off
6	6	During firing	3.2–20.0	13.5	On

TABLE V

Analysis of Urine Samples for Lead

Range	Hours of exposure month	Lead micrograms per liter						
		Nov	Dec	Jan	Feb	Mar	Apr	May
1	160	nil	nil	37	62	128	71	—
2	0– 12	26	29	13	17	45	36	15
3	5– 12	—	30	34	27	—	—	—
4	7– 30	—	37	19	52	18	18	18
5	3– 7	5	58	34	28	30	38	40
6	120–164	94	102	172	164	125	110	72
7	8– 10	—	16	52	39	21	22	—
8	0– 18	—	—	29	20	33	24	62
9	1– 10	—	—	—	—	—	36	62

were included in the survey. These ranges were in use for only a few hours per week but in at least one range children were given firing instruction All tests in these ranges were made during firing of .38 revolvers. Data is summarized in Table IV.

Analysis of Urine Samples for lead

A selection of the urinalyses survey results from each range are recorded in Table V, together with an estimate of the time the various individuals were in the firing ranges. All of the lead in urine results were summarized by hours of exposure during the previous week, hours of exposure during the previous month, exposure to rounds fired during the previous week and exposure to rounds fired during the previous month. Average lead results varied from 29 to 42 micrograms except for men exposed more than 30 hours per week (76), 120 hours per month (97), more than 1,000 rounds of ammunition per week (56) or more than 5,000 rounds of ammunition per month (72).

According to Schrenk,[6] the normal urinary lead excretion varies from 10 to 80 micrograms per liter in large samples of a liter or more; and from 5 to 120 micrograms per liter in spot samples of 50 ml or more. Schrenk states that the mean value is in the order of 30 micrograms per liter and that values of 150-200 micrograms per liter have generally been used as a maximum safe limit. From an inspection of Table V it will be seen that only one individual was found to be excreting more than 150 micrograms of lead per liter during this survey and that only one other individual approached this limit. Most of the urine sample results showed lead in very much lower concentrations.

From the high lead-in-air concentrations which have been reported above it might have been expected that urine lead samples would have shown more evidence of lead absorption. We at first thought that the low urines were an indication that air samples contained many large size particles which could not be inhaled. However, the high concentrations of lead which we found after firing had ceased, would seem to indicate that this was not the case. Another possible explanation is that the lead is in a form which cannot be readily taken into the body. We rather doubt this as we would expect it to be in the form of a fine fume. Deposits on a few Millipore filter samples examined by microscope were found to consist largely of particles below one micron in size. A third explanation is that it might be related to the fact that exposure in most cases is discontinuous. Kehoe, in a recent paper,[7] states that when the respiratory exposure is discontinuous the individual reaches a plateau with respect to his rate of urinary excretion. Most of the individuals from whom lead samples were obtained had a very discontinuous exposure.

Control of the Lead Hazard

While the urinalysis survey did not indicate any substantial degree of lead absorption the fact that over the past two years three individuals in this group of firing ranges have shown excessive lead absorption, and at the same time substantial air concentrations of lead have been recorded, indicates that the exposure should be controlled.

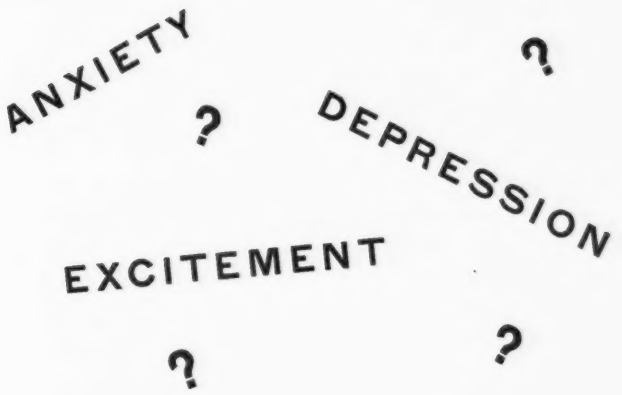
The most important control measure is a good ventilation system. For individual ranges, we have recommended the supply of tempered fresh air with some form of draftless distribution over the firing end and exhaust ventilation from the target end of the range. Our aim has been essentially to flood the occupied end of the range with fresh air and we have recommended supply and exhaust volumes sufficient to maintain a linear flow towards the targets of at least 25 feet per minute. We have not attempted to restrict the cross-section of the range as has been suggested by other investigators.[1] This certainly has the advantage of greatly reducing the air volumes required but imposes some restrictions in the use of the range. Larger volumes are also desirable to aid better visibility during periods of considerable firing activity.

In addition to good ventilation firing ranges should maintain good housekeeping standards in order to prevent contamination caused by redispersal of settled dust.

References

1. Technical Committee, Sporting Arms and Ammunition Manufacturers' Institute: *Report on Health Hazards in Indoor Shooting Galleries Due to Toxic Dust and Fumes.* (Dec. 1958)
2. Atkins, D. N.: Canadian Industries Ltd. Personal Communication (May 1959).
3. Detroit Bureau of Industrial Hygiene: Long Illness of Police Officer Leads to Discovery of Lead Exposure on Firing Range. *Industrial Health Monthly 11*: 185 (Dec. 1951)
4. Anon.: Lead Poisoning is Caused Occasionally at Shooting Galleries. *Baltimore Health News 24*: 133 (June 1947).
5. Alpaugh, E. L.: Lead Concentration in Indoor Firing Ranges. *National Safety News* 77: 14 (Feb. 1958)
6. Schrenk, H. H. Hygienic Lead Standards. *Ind. Med. and Surg. 28*: 106 (March 1959).
7. Kehoe, R. A.: Responses of Human Subjects to Lead Compounds. *Ind. Med. and Surg. 28*: 156 (March 1959).

Understanding human behaviour



BY WARREN C. JOHNSON, M.D.
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This article is based on a lecture given at the Jewish Community Center, Washington, D.C., February 25, 1960. The lecture was third of a series of the 1960 Memorial Lecture Program co-sponsored by the District of Columbia Association for Mental Health, Inc., and the Adult Education Department of the Jewish Community Center.

To us who are physicians, it is humbling to acknowledge that we are still beset by the challenge that Macbeth hurled at the doctor who, you will recall in Act V of the play, had told the general that Lady Macbeth was "not so sick as she is troubled with thick-coming fancies that keep her from her rest." So Macbeth demanded of the doctor—

> Cure her of that,
> Canst thou not minister to a mind diseased,
> Pluck from the memory a rooted sorrow,
> Raze out the hidden troubles of the brain,
> And with some sweet oblivious antidote—
> Cleanse the stuffed bosom of that perilous stuff—
> Which weighs upon the heart?

The doctor had no response except: "Therein the patient must minister to himself."

We have indeed come a long way since Shakespeare's challenge of over three centuries ago. How is this accomplished?

Understanding why we behave in a particular way is the first step toward stopping unhealthy behavior. If we understand what is behind our feelings and actions it can be done. It will take time, but it can be done.

It is only recently that people have discovered that feelings of constantly being irritated with the world and not getting along with people are really signs of emotional illness. And it's only recently that they've learned that there are ways of treating these problems. Many people don't get help with their problems because they refuse to believe they have any. Other people feel they have problems, but they can't quite put their finger on what is wrong. This is the type of person who has vague complaints about pains and stomach trouble. If he consults a doctor he is advised there is nothing wrong physically. But, being wiser about such things, the doctor goes on to find out that the patient has family or work troubles.

There are times when everyone knows not only that he has problems but that they are affecting his feelings and his behavior. That's a good sign. If the problems are examined more carefully a better understanding of how to smooth them over will result. This helps not only the person with the problems but also those around him.

Early Signs of Emotional Illness

Let's look at some of the common signs that indicate things aren't going so well.

ANXIETY is the most common of all. This is much more than mere tension or worry about a real danger. It is a fearfulness, restlessness, insecurity that cannot be traced to any specific cause. Or, if there is a real cause, the feelings may be all out of proportion to that cause. Anxiety may not show in facial expression, and a person may really believe that he has no anxiety. However, a conversion mechanism (which I will discuss later) is at work. He has stomach trouble or heart flutterings, and other physical complaints or disorders.

DEPRESSION is another common sign. This is the name given for discouragement and despondency. Sometimes depression and anxiety are combined, so that one person may have physical pain, low spirits, sleeplessness, fearfulness, etc.

EXCITEMENT is another. There are people who are always excited, always on the go, never able

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to sit still. It is normal to be excited at times. Anticipation of a special treat or a big occasion quite naturally causes a certain amount of excitement. However, when the excitement lasts for days instead of minutes and hours, and when there is no real cause for it, then it is unnatural.

WITHDRAWAL, always avoiding people and social groups, is another sign of emotional illness. When people who have usually been sociable and friendly want to get off alone and avoid other persons, even their best friends, they are withdrawing. Sometimes they think that nobody wants to be with them.

QUEER OR UNUSUAL BEHAVIOR is another sign of personality trouble. The person may be aware of his odd actions or he may not be. It may be a habit he's had nearly all his life, like the habit of talking too much or too loud. On the other hand, the odd behavior may show up suddenly. Serious personality disturbances sometimes show up first in unusual kinds of behavior; going off in the car miles away without telling anyone, getting drunk, getting mixed up in brawls, etc.

How can we avoid having such symptoms? How can we tell when to get help? To find out, we can ask ourselves these questions:

... Do I have doubts as to whether what I am doing is worthwhile?

... Do I miss work a lot because of vague physical complaints for which the doctor can find no physical cause?

... Am I a "worry-wart"?

... Do I always have difficulty concentrating, even when life is calm and quiet?

... Do I feel more or less discouraged all the time?

... Do I argue with my family a lot?

... Do I feel at cross purposes with things?

... Am I usually afraid of something?

... Am I a chronic complainer? Are most things unsatisfactory to me?

... Am I always resentful or irritated?

Everyone has occasional responses of these sorts. If, however, we must answer YES to always feeling this way — it would be advisable to consult someone who can help us find out how to change.

Once we get to the place where we can recognize our problems and want help, there is a lot of hope. This is true whether our problem involves our personality or something in our environment.

There are three ways of working out solutions to emotional problems. We can sometimes find a remedy by changing ourselves; we can change the environment; or we can alter both.

The catch is that often, because of deeply formed habits of acting and thinking, we can't see what kinds of changes to make in ourselves. Nor do we know what changes to make in our environment. Often if we struggle with the problems ourselves, we make things even worse. The question then is, how to get help.

To get help people must first WANT help. This is the purpose of discussions on mental health — to help people understand more about themselves and how they function so that they can know whether or not they need assistance and if so, what kind. If they decide they want help after examining their problems it's up to them to get it. Of course, some problems have a way of evaporating under close scrutiny. The problems that don't disappear on examination often shrink in size when something constructive is done about them.

Sometimes family and friends can help. However, very often the family is the center of the problem, and too often an unwise choice is made in the friend who is told of the trouble. Often the help of family or friends isn't enough. This may be true when the problem remains unsolved for too long. Emotional problems are like snowballs, they grow and grow fast. Sometimes the problem is very acute or appears suddenly and therefore is overwhelming. Relief from emotional as well as physical complaints depends upon treatment, the earlier the better.

The family doctor can help. He knows the person and his family. Even if he isn't an expert on personality problems he has had wide experience with them. If the family doctor thinks the problem is serious and beyond his help, he will refer the person to the doctor who he thinks can best handle the problem. This is where the psychiatrist, the specialist in the prevention, diagnosis, and treatment of emotional problems, enters the picture.

We have learned the importance of treating people before they become acutely sick, while they are still able to stay on their jobs and live at home.

Some method of Avoiding Emotional Trouble

In brief, emotional difficulties are part of life. Mental health depends on facing them and finding the best way to overcome them.

Improving mental health depends on learning about ourselves. Five areas of mental health are important to our general welfare. These are:

1. Our relationships with other people.
2. Our code of behavior.
3. Our sources of satisfaction.
4. Our ways of obtaining security.
5. The value of our goals in life.

Relationships with other people. Our ability to

get along well with other people is the most important factor making for personal happiness and effectiveness. This ability really depends upon whether we can love and are loved more than we hate. Mental ill health is almost always related to the fact that one does not give and receive enough love to balance hating and being hated. We have to learn to love. We should have learned to love from our parents. If we didn't receive love as a baby, we usually have great trouble in learning to give it later — unless we get help with the problem.

What can we do about it now? First, see what kind of problems we think we have in getting along with others. Second, where we fall short we can make an effort to change our beliefs or practices. By real and continued effort anyone can make enormous changes in attitudes, points of view, and actions. In fact, we don't necessarily have to know what happened back there in our childhood to change the present situation.

Codes of Behavior. As personality develops, controls are created to keep behavior in line. Parents carry the responsibility until the child is ready to do so. Children usually take over their parents' standards about how people should act.

Society, like our parents, has certain beliefs about how we should behave. These are set up in the form of laws, and everyone living in our society must obey these laws or suffer the consequences. Churches, too, have set forth their creeds and statements of moral laws to serve as a basis for living with other people. Anyone whose code of behavior isn't motivated by unselfishness a lot of the time is sure to fail in his relationships with others. Such a person can't hope to get the most out of life. He will stay closer to babyhood than to adulthood.

Inspect yourself to see how many times you have taken the "me first" attitude lately.

One of the most difficult lessons to learn is that of self-control. There are so many times when we can "get away" with something. Our intelligence tells us the things we can do and weighs the wisdom of doing one or the other. If our conscience is what it ought to be, it tells us what we should do.

If we are going to hurt ourselves or if we are going to cause other people distress or pain or sorrow, then by any standard, the act is wrong.

Sources of Satisfaction. Satisfaction results from meeting a personal need or wish, from a sense of achievement, from doing something well in spite of difficulties. The person who doesn't find satisfaction certainly isn't happy.

Satisfaction is one of the chief supports against our troubles. Real satisfaction depends upon meeting the needs of the inner you in a way of which society approves. To have good mental health, we will certainly have to learn how to find satisfaction in whatever we have to do. Satisfaction does not depend on someone else.

If we are not satisfied with the work we are doing: (1) we can change what we are doing; (2) we can simply quit; (3) if it's something we "must" do, we can find out why we are not satisfied.

For those who are not happy: (1) Venture into a new activity. New adventures do not have to lead away from home. (2) Learn to re-learn the joy of reading. (3) Create something. (4) Hobby. (5) Friends.

Obtaining Security does not mean just protection. It means feeling comfortable inside yourself. Security has to be planned. Every adult has to develop his own sense of security.

The Value of Goals: We must know where we want to go if we are to get anywhere. It is so easy to drift along. The people who go places and do things make the most of every situation and are ready for the next thing that comes along.

Emotional Maturity usually takes most of a lifetime to attain. A mature person is one who finds greater satisfaction in giving than he does in receiving. He is able to form satisfying and permanent loyalties, receiving as well as giving satisfaction in such relationships. He is creative, able to learn and profit from mistakes, and is relatively free from fears, anxieties and tensions.

Use and Misuse of Defence Mechanisms

In combating emotional difficulties we resort to certain mental defense mechanisms. Let us consider these defense mechanisms:

INTROJECTION — is the absorption of emotional attitudes, ideals, wishes and feelings from others.

Conscience comes from attitudes and ideas absorbed from others as a small child — even though we don't remember a time when we didn't have a conscience. Our ideals and present standards of behavior did not originate within us. Our parents' beliefs regarding morals, education, or working conditions automatically became our beliefs. Education and experience changed these somewhat, but even these changes are absorbed mainly from the people around us.

Our prejudices are likely to be those of our parents.

Sometimes, however, resentment toward parents causes children to take the opposite stand on various subjects. A great many young people have periods when they defy their parents and hold different points of view, taken over from people their own age. This is rebellion, not only against parents, but also against themselves.

There are many different ways to introject. We absorb the spirit of a party — if it's a good party we have a good time. If we are with someone we like we usually accept his or her ideas. The process of introjection is automatic, therefore we don't recognize it at times.

Prejudices against people of a different color or religion are the results of the feelings of the people in our environment. If we try to explain why we are prejudiced, the chances are we will ignore the real reason: that we absorbed our attitudes as children. We became subjective able only to see something the way we want and expect to see it.

To be objective we must be able to see ourselves as others see us. This also means considering the pros and cons of a problem before making a decision, and not going only on the basis of "reasons" that we have automatically absorbed from someone else.

IDENTIFICATION — Little girls playing with dolls are imitating their own mothers in the treatment of doll children. If the little boys have fondness for their fathers they imitate them. This is natural — to imitate those around us. This is how we learn to do many things. The boy does not walk or act like his father just because he is his father's son. He automatically imitates his father's mannerisms and behavior, as well as absorbing his father's attitudes and ideals.

Identification goes on through life. When we fall in love with somebody we find ourselves behaving and believing as he or she does. All mentally healthy people are great imitators. No one wants to be too "different," and all of us want to be identified with the people we like.

When a fellow felt that he really belonged to a B-29 crew, he identified closely with the other men. He accepted the ideas and opinions of the unit. Its problems became his problems. And that's the way members of a closely knit group should feel — whether it's a club, family, or neighborhood gang.

SUBLIMATION — In the course of growing up the adult must learn how to satisfy his desires for love and attention, and freedom to do as he pleases, by behavior that is approved by the people with whom he lives and works. He can't do as the baby does: demand what he wants when he wants it and expect to get it.

Everybody has two high pressure psychological drives which continually seek expression in one way or another. One drive is toward loving which is expressed in thoughts and acts that are creative, constructive, healthful, generous. The other drive is toward hating, expressed in thoughts and acts that are destructive and hostile. In order to live in accordance with the laws, customs and morals of people around us, we must "sublimate" many of the impulses connected with our drives. In other words, we must change into activities which are approved. Inability to do this, which results in our misbehaving, means that we are emotionally ill. Sublimation, then, is the mechanism by which we convert our primitive animal love and hate into activities of which society approves. A person who cannot sublimate is showing signs of emotional illness.

Toward the end of his first year or early in the second, the baby manages to get his soiled diaper off and makes a grand "mess". He has no feeling that doing this is wrong or dirty or even out of place. When he eats, he thoroughly enjoys himself, smearing food all over his face. Soon, however, he is scolded and spanked for this behavior, and he learns that smearing is dirty, even "nasty". So he learns to make mud pies or play in the sand instead, satisfying his desire to make a mess while getting the approval of his parents.

Sublimations of this desire to smear are painting, clay modeling, stirring up a cake, mixing concrete. Substituting adult interests for infantile desires is sublimation. This substitution is usually made without our realizing it; it is automatic for the individual who grows up psychologically.

COMPENSATION — One of the mechanisms all of us use is compensation. In everyday language, this means to pay or reward ourselves for something we have done. In psychological language it refers to the way we make up for a lack of some specific ability. We unknowingly work very hard to develop an asset to substitute or "compensate" for some imaginary or real handicap.

Adults do this as well as children. A man compensates for his dull, monotonous job by learning to fly an airplane in his spare time. Some people work very hard to overcome handicaps.

Compensation is especially valuable to physically handicapped persons. For instance, a blind person develops with training an unusual sense of touch in his fingertips, so that he can read the raised printing of braille. The need to overcome such handicaps often results in real achivement and even fame. Milton, the blind English poet, had to have wires strung across his manuscript so that he could write in a straight line. He overcame his handicap to do what was then nearly impossible for a blind person to accomplish.

Whoever we are, we develop ways to find satisfaction that compensate for what we cannot do or have.

As a child, Glenn Cunningham was told that he could never walk again, yet he later starred as one of the greatest mile runners of all time. Many honor roll students are compensating for their lack of athletic ability. The girl who isn't as popular

as she would like to be sometimes withdraws from her friends to find compensation in extensive reading. If you are poor in one thing you may find yourself talented in something else.

A special kind of compensation is used by the individual who substitutes a gift for action. He makes a present to someone instead of giving him time and attention. Haven't you found yourself trying to be especially nice to the person that you were sore at last week? Some parents don't have very much time for their children. In such cases they may try to pay off with money or gifts or extra use of the car.

Compensation isn't always a "bad" mechanism. It helps greatly to solve problems when the path seems blocked in the direction we want to go. It makes many people strive and achieve much more than they would otherwise. It is "good" or "bad" depending entirely on how it is used.

RATIONALIZATION — Rationalization is the mechanism that saves our hide and feelings a thousand times a day. It's the method by which we justify the way we think, feel, and act. We also use it to explain in foolproof ways why we needn't do something, or why we didn't do it. Unlike a lie or an excuse that we've consciously thought up, the mental mechanism of rationalization is an unconscious process. We sincerely believe we are being truthful.

These rationalizations are used to defend our likes as well as our hates. We use them to explain why we prefer blondes or brunettes, why we don't like spinach or mice, why we're afraid in the dark. Rationalizations, of course, aren't the real reasons. But they're necessary because the real reasons originated in our personality long before we can remember. It is fortunate that we can use rationalization, because many of the real reasons for our behavior are painful to examine.

IDEALIZATION — When we overvalue something, far beyond its real worth, to make ourselves feel good, we are using the mental mechanism of idealization. We may idealize ourselves or may idealize others. People in love are apt to do a lot of idealizing.

Most people idealize themselves a great deal. And often it's a healthy thing to do. After all, if we don't take some pride in ourselves and think we are reasonably successful, the chances are we won't be.

No matter how mature we become, we are really always the center of our own life. Our own needs, satisfactions and security are most important — even though only to us. Therefore, we must think well of ourselves to have confidence, poise and perspective. Unfortunately too many people idealize themselves too much, and this shows up in conceit.

If we are unable to see at least some of our own faults and to admit our mistakes, then we are using idealization to our own great disadvantage. Everyone does this at times. We are headed for trouble when we do it too often!

REACTION FORMATION — We said these defense mechanisms are usually expressions of an unconscious wish or need. Reaction formation so changes the unconscious wish that when we act — we do just the opposite of the real wish. For instance, people who are overly clean fuss about every little speck of dirt. In the process of growing up they learned cleanliness as we all did. But they went even further. Their unconscious enjoyment of dirt is still so strong that the conscious part of their personality can control it only by insisting that they be too clean!

We can suspect this process of reacting when we feel we just have to do something. The extremely punctual fellow is not just made that way; he has selected that pattern of response to inner demands. So he has to be punctual in order to be comfortable. Some compulsions — responses to unconscious demands which force a person to act in a certain way — may be symptoms of serious maladjustments or mental illness.

A mild degree of reaction formation is desirable. Otherwise it is too comfortable to be dirty or slovenly. The very careless, untidy person hasn't learned to use reaction formation enough.

DISPLACEMENT — Displacement is a psychological trick by which our personality quite unknowingly transfers an emotion caused by one idea or person to another idea or person. A man who has had a bad day at the office acts cross at his wife when the wife hasn't done a thing to irritate him.

We can also displace love. This is healthy when we feel secure because we believe that people love us. We then can pass on some of that love to people whom we know don't love us. It is the application of the principle "love thy neighbor as thyself."

Some displacement of love is unhealthy. There are people, for instance, who give all of their love to a dog when there are people around them who need it much more. Others overuse displacement. On the other hand, its occasional use in understandable. The better we understand what we are doing, the less often we will misuse that mechanism.

PROJECTION — You know people who blame everybody else for their troubles, who never have any faults of their own, and who are always suspicious. The chances are that they are using the mechanism of projection. They are unconsciously disowning certain ideas or wishes and attaching them to someone else. The use of this mechanism

(*Continued on page 23*)

Rehabilitation IN INDUSTRY

BY G. GINGRAS, M.D. (1)

G. GAGNON, M.A. (2)

The rehabilitation of the handicapped, and the more efficient utilization of this manpower in industry are both a responsibility and an opportunity to those who shape personnel policies in industry, those in charge of industrial health and safety, physicians and paramedical personnel specialized in rehabilitation, the community at large, industry, unions and government.

Today, we are able to do more than ever before in overcoming the crippling after-effects of injury, disease or congenital deformity. The advances of medical knowledge in recent years and research activities in accredited rehabilitation institutions enable us to better evaluate the soundness of policies and procedures, to verify that which is sound and to reassess factors that are negative in results.

Thus, it is possible to offer new hope to thousands of people who, less than even a generation ago, would have been written off as beyond help. The support of those close to them and all others concerned with the welfare of their fellow citizens may now take on new dimensions. While many people are progressively becoming aware of what can be done in the realm of rehabilitation, they might be still inclined to think of it as an expensive service evolved solely from an altruistic feeling.

In our highly industrialized country, with the advances in rehabilitation techniques, the expanding economy and the rising standard of living, we can look forward to considerably improved methods of assistance. Rehabilitation of the handicapped can no longer be successful on a purely humanitarian basis without functional, adequate and well organized programmes. Therefore, this paper will not deal with the problem of disablement from the standpoint of ethics. On the basis of scientific contributions and experience, my intent is to explore what has been done and what is most recommendable with regard to rehabilitation in industry today.

The economic foundations of rehabilitation will be considered first because of their direct bearing upon our way of handling the problem of physical impairment and their impact upon disabled individuals. Of course, physically handicapped men and women are entitled to the best rehabilitation services that can be provided, and there are few people today who would deny them the opportunity for maximum restoration of physical, mental, social and economic function. Pension and disability allowances might provide the individual with a minimum purchasing power. Yet, there is no satisfaction in a personal income that provides merely the absolutely essential goods and services. The disabled wants his revenue to allow also for investments in his own abilities, family and community. He is fully aware that he must have a minimum standard of living if he wants to help shape the policies of the world in which he lives in a responsible and effective way. He may wish to perform work just because it appears to be the best means of expressing his personality or creative energy, if not for financial gain. Present rehabilitation methods and the almost incredible degree of specialization and intricate division of labour prevailing in many countries have all contributed to increased opportunities for absorption of the disabled into the work forces.

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Rehabilitation is an investment and this underlying economic aspect has proved so sound that a number of insurance companies have adopted the rehabilitation approach to the settling of claims rather than the purely financial settlements which leave the injured person with some money perhaps but with his total disability. Likewise, several Workmen's Compensation Boards in Canada and the U.S.A. operate rehabilitation services to supplement the care obtainable through the hospital system. The 500-bed Hospital and Rehabilitation Centre operated by the Workmen's Compensation Board of Ontario can be considered as an outstanding example of this.

Those responsible for production costs which include corporation taxes and the workers who are all tax payers might be interested to hear some figures showing how rehabilitation can be a sound financial investment in human resources. According to Canadian information available on a group of 1,000 seriously disabled persons rehabilitated in 1955, Ian Campbell reports that the first 630 cases concerned and their dependents had received annual disability and maintenance allowance transfers of about $283,000. In their first year of employment following rehabilitation the total revenue of the group reached $1,200,000. Their contribution to public funds and collective government investments for years to come will pay astonishing dividends to rehabilitation cost.

These figures can easily be prorated to a sizable proportion of our million Canadian handicapped people who could be given the opportunity to be self-supporting. Let us use U.S.A. statistics to demonstrate the financial value of rehabilitation. In 1951, 66,000 handicapped persons were rehabilitated. More than 8,000 of these received financial assistance to the sum of $5,700,000 annually. The expenditure of $4,000,000 to rehabilitate them is less than three-quarters of what it would have cost to maintain them for one year. Furthermore, their earnings in the first year following rehabilitation was approximately $40,000,000 and they pay an estimated $1,000,000 annually in federal income taxes. That is, $1,000,000 return on public investment from rehabilitated disabled workers plus a national cost reduction of $5,700,000 which would have been spent for maintenance of this group in one year alone had they not been rehabilitated.

Such results are contingent upon the quality and continuity of rehabilitation services provided from the onset of the disease to resettlement. Physical training, industrial workshops, vocational training and placement are all necessary steps in the process and each of them is interrelated and must be coordinated at the level of planning as well as at the level of individual rehabilitation. Medical rehabilitation remains the cornerstone of this work, but it must be integrated with industrial rehabilitation, or else, without proper placement, all efforts may be futile.

Let us examine the concept of total medical care with rehabilitation as its ultimate goal. Nowadays it refers to the relief of symptoms, extends to the restoration of function and return to normal living. This is the normal course of events in a case of pneumonia, appendicitis or of a simple fracture. But when an individual suffers an amputation of a limb, or a cerebral hemorrhage accompanied by hemiplegia, his return to normal living may be extremely complicated by a permanent disability and the subsequent psychosocial impact. Wherever full restoration is denied, considerable recuperation can still be gained and through the application of physical medicine and psychosocial techniques, the patient can be helped to converge all his faculties to attain maximum degree of functional rehabilitation.

To overcome the remaining disability two other sets of methods were developed. The first consists of teaching the patient compensatory ways to achieve his maximum if not full function. For instance, the kinesthetic sense in the blind is developed to a far greater degree than in the sighted person. The second brings forward the possibilities of substitution and retaining in the use of a limb. This includes muscle transplantations, new reflex patterns, trick motions or even training a right-handed hemiplegic to use his left hand to eat, write and so forth. Improved techniques in prosthetics enable us to provide artificial substitutes. Orthotic appliances help to support weak muscles and, in other cases, self-help devices can be of considerable assistance to perform activities of daily living such as eating, writing, toileting, dressing and undressing.

Recuperation of functions, substitution and compensation are all geared to obtain maximum function not only of damaged organ but also of the whole patient. As pointed out by Main, "This final target in the treatment of human ill is not always capable of realization to the full and it is well to regard rehabilitation as that phase of the continuous unending process of biological adaptation between man and his environment that follows any experience such as illness, which alters or damages the capacities of the individual". Thus, rehabilitation must rely upon the contribution of psychosocial techniques industry and the community at large, otherwise the handicapped may experience enormous difficulties trying to reach a satisfactory level of adaptation in a productive life.

Here we must be fully aware that work efficiency does not depend on anatomic perfection but rather

on the ability of a worker to perform a particular job. Physiologically man can live with half of one lung, a third of one kidney, 1/64 of a liver, half the normal volume of blood and without a stomach and, although far from whole anatomically, he can still function effectively. Likewise, handicapped workers have repeatedly demonstrated that many of them can attain a level of functional rehabilitation to enable them to cope with the demands of competitive employment.

Therefore there is no reason why the handicapped should not be given the same opportunity as the non-handicapped in industry. The basic principles of selective placement apply to: 1) match skill experience, training responsibility and personality traits of the individual with the job; 2) respect the interests and freedom of choice of the candidate. Otherwise the motivation and emotional stability of the worker cannot be maintained.

One of the reasons often given by employers for failure to make use of handicapped workers is that their insurance rates may be increased if they hire a disabled person. This belief is based on misunderstanding of the compensation procedures since the employment of impaired workers does not affect the insurance rates, which are based on the relative hazards of the industry and the employer's previous accident experience. It has been clearly shown that the accident rate is not increased when the disabled are properly placed. We can look forward to more interest and action on the part of employers as soon as they realize that there is no threat of higher insurance premiums as a result of employing the handicapped.

The establishment of second injury provision protects the employers from any additional costs by providing for the payment of compensation from a second injury fund for any additional disability arising from the combination of first and second injuries. These provisions hold the current employer liable only for the second injury. There is undue importance attached to the danger of second injuries. According to Dr. Henry Kessler's experience with a group of 3,376 cases, only 12 sustained a second injury. He points out that the causation of accidents may be traced to technical and human factors but physical defect was far from being a major contributing factor. Incidentally, the findings of a survey conducted in Montreal on the incidence of traffic accidents involving paraplegic drivers using hand controls were unofficially discussed with representatives of insurance companies. The opinion is that the accident rate of this group is lower than that of the able bodied individuals. There are definite advantages in the employment of disabled workers. The handicapped workers have clearly shown that as a group they are often more conscientious, have a higher safety record and can be hired with more confidence and anticipated success than any comparable group of unimpaired people. There is overwhelming evidence that, given the opportunity to perform a job for which they are individually equipped, they maintain a higher level of productivity and larger output. A survey of company practices conducted jointly by the Chamber of Commerce of the U.S. and the National Association of Manufacturers demonstrates that handicapped workers compare favourably with the non-disabled on four main points: *less absenteeism, greater reliability and better work habits, lower personnel turnover and equally good job performance.*

However, there are definite factors to be considered when dealing with the placement of disabled individuals. Unless the actual employment is productive for both the employer and employee, those responsible for restoration, retraining and placement may fail unless the following requirements are met:

1. The placement must be effected on a selective basis, that is, the candidate must have the skill and physical ability to perform a particular task.
2. He must not be a safety hazard to himself and his fellow workers.

At the same time, the disabled applicant is entitled to and should be assured of certain considerations:

1. To place him in a job fitting his qualifications and physical abilities.
2. To ensure that in every transfer or promotion the physical capabilities are as well suited to the job as are his other qualifications.
3. To inform him of his physical conditions and advise him on the improvement and maintenance of health.
4. To provide work which will not aggravate the actual disability.

The industrial medical officer helps the plant's staff to understand the needs of the worker for health guidance and protection of the job through frequent observations of the worker's adjustment. He may co-operate also by suggesting provision of special chairs, tools, or other work arrangement as necessary. He makes sure that fellow-workers will assist in case of fire, explosion or other emergencies. The extent of participation to this health programme also depends upon agreement between the agencies administering vocational rehabilitation in the province. Another responsibility is the coordination of the plant's rehabilitation programme with community facilities.

Several important occupational tools have been developed such as the American Dictionary of Occupational Titles which identifies approximately 22,000 jobs, job family services, interviewing aids and manuals on placement techniques. However, available job descriptions do not always fit the labour market of a particular community. Occupational analyses may sometimes be too vague to determine whether or not a particular individual can be successfully placed in a job despite his limitations. It is highly desirable to narrow down further the physical and vocational capacity assessment of a candidate. Equally important is to keep more specific data on work physiology and the aptitudes required for a particular job. We can look forward to wider use and further elaboration of present assessment scales of physical and environmental factors. Work tolerance, general stamina, medical contra-indications, general mental abilities, vision and hearing are important elements that cannot be neglected.

Whenever competitive employment is denied due to the severity of the handicap, the following possible solutions remain: homebound, self or part-time employment, work-and-live-in-accommodations and finally, sheltered employment.

Great Britain where sheltered employment has a long history affords a fine example. Voluntary societies started well over 100 years ago to set up special workshops for the blind. After the first World War several ex-servicemen organizations opened workshops to serve the large number of war disabled. The latest step in this field was taken in 1944 when the Ministry of Labour set up a non-profit organization, Remploy Limited, for the disabled unfit for employment under ordinary competitive conditions. By the end of December 1953 this organization had established 90 factories and provided employment for more than 15,000 men and women. This achievement was largely supported by state grants but the aim of Remploy Ltd., is to become as self-supporting as possible. Although it cannot be considered entirely successful by financial standards alone, there can be no doubt as to its value in human terms. One of the most interesting results of this tremendous venture is achieved by the re-socialization of the disabled. It was found that many individuals were able to re-enter the open labour market after a year or two with Remploy.

It seems that sheltered employment is a necessity for a number of severely handicapped persons and also for those who need psychosocial readjustment before returning to the open labour market. However, it is only second best to employment in industry and can only be complementary to other rehabilitation measures. For instance, in Great Britain one deals with a programme based on a quota legislation, under which all employers with 20 or more workers must hire registered disabled persons amounting to at least 3 per cent of their staff. A placing service is available through the Disablement Resettlement Officers at each of the Ministry of Labour's employment offices. Courses of industrial rehabilitation are given at the Ministry's own rehabilitation units. Vocational training courses in a variety of trades are sponsored by Government and private training centres. It is also worthy of mention that some voluntary organizations have initiated residential training centres.

A number of European countries have also adopted the quota system. It was first introduced in Germany in 1922 to take care of the war disabled. According to available information, quota legislation is at the present enforced in at least the following countries: Austria, Czechoslovakia, France, Germany, Great Britain, Greece, the Netherlands, Hungary, Israel, Poland, Italy and Yugoslavia. The quota varies from 2 to 10 percent and applies in certain countries only to the war disabled.

The policy differs in other countries where emphasis is laid on the provision of placement services for the handicapped. Although the employer has no legal obligation to hire handicapped persons, a special placement service has been incorporated within National Employment Schemes. As a rule, the non-vocationally handicapped are placed by the regular placement section, whereas those requiring special placement are referred to personnel trained to deal with their needs. The most comprehensive placement programmes of this type are found in the U.S.A., Sweden and Canada.

The relative merits of the quota legislation and organized placement services have been the subject of much discussion. Both have their advantages and shortcomings. The quota system may provide sound basic publicity among both employers and workers and also possibly demonstrate the industrial value of disabled manpower. It seems that Canada could profit by this experience and concentrate on improving employment opportunities for the disabled rather than to establish a quota legislation which might prove too rigid to promote placement on the basis of individual abilities and interests. There is a strong feeling among rehabilitation devotees that goodwill supported by objective facts and faith will go far beyond the results prompted by law alone.

Endorsement in principle from employers, associations and trade unions is not sufficient. Management, foremen, industrial physicians and placement personnel, as well as fellow-workers, must recognize the potentialities of the impaired workers.

The identification of general physical fitness with working capacity must gradually give way to a concept of abilities in relation to the demands of the job.

In spite of tremendous efforts by governments and voluntary organizations, more and still more services for treatment and training of personnel must be instituted. Likewise, better integration of services could permit a fuller utilization of existing facilities. All this requires imaginative support and financial assistance. I would like to ask at this point how much industry spends annually on rehabilitation and research in rehabilitation in this country, in addition to their contribution to Workmen's Compensation. The Federal Government has endorsed provincial health services by creating substantial grants. In some cases financial help is supplied, provided it is matched with an equal contribution by the province concerned. Sums in excess of $39,000,000 were given to provinces under the health programme. A special yearly rehabilitation grant of $1,000,000 was added for specific needs. In many cases where the working capacity of the disabled person had undergone a change as a result of physical impairment, retraining for a new occupation is necessary. However, this cannot be improvised in three easy lessons.

Schedule R. provides for vocational training of disabled persons allowing for maintenance during training and transportation. In 1958 alone, 1,183 persons were trained in more than 40 trades and occupations. The federal share of this programme was $270,362.62 of which $101,691.42 went to Ontario alone. Quebec has not signed any of the vocational agreements since 1955. However, full cooperation is extended by the Trade Schools of the Quebec Department of Youth and Welfare.

Apart from providing leadership and financial assistance at all levels of rehabilitation, industry is apt to play a prominent role whenever the "vocational convalescence" is required to supplement rehabilitation services whether in the form of part-time employment or of industrial workshop. Medical Rehabilitation centres are equipped to initiate vocational rehabilitation in building up work tolerance, improving working habits and maintaining the patient's confidence towards his future prospects. Rehabilitation centres simulate working conditions to a limited extent to allow for functional recuperation and pre-vocational guidance; they cannot however duplicate a large variety of occupations nor create the stress of getting back to work. An outstanding retraining scheme operated by the Vauxhall Motors Ltd., England, could be emulated with profit. The injured workers are given remedial physical exercises in the form of productive work in a natural working environment, either in the retraining shop or in the man's normal place of work in the factory. The results of such industrial workshop are most rewarding as long as they do not remove the worker too long from normal working conditions.

It cannot be overemphasized that the attitude of the employer himself may be a determining factor in the rehabilitation of a patient. Working prospects are an incentive in physical improvement especially if they are guaranteed by the former employer. Personnel and placement officers are prepared to render valuable assistance to industry in this matter. Special Placement Officers are familiar with both medical, psychological and vocational assessment and industrial requirements. It would be futile to help handicapped persons across the long valley from disability to employability unless there are suitable jobs waiting for them.

Professional industrial health services can be relied upon for still greater contribution. In this respect it would seem a wise move to avail medical and paramedical industrial personnel with opportunity to become acquainted with the basic principles and practices of rehabilitation. In addition to regular lectures they may find periods of observation and study in medical rehabilitation centres extremely helpful.

The role of Workmen's Compensation Boards is of cardinal importance in many respects. Their attitude towards the patient is fundamental. It was often noted that in cases of industrial casualties, the individual was torn between the desire to benefit from the highest possible compensation allowances and the will to overcome his disability. This phenomena now known as "compensation neurosis" calls for an early settlement of claims.

Research is of paramount importance on three fronts:

A) *to analyze and demonstrate the working capacity* of disabled persons for the purpose of providing widespread and sustained publicity of a factual kind with special reference to the work performance, accident rate and stability in employment.

B) Research into the work *physiology, psychology and emotional patterns of the handicapped* is important and experimental programmes are being conducted in several countries. The activities of the work clinic of the Karolenska Hospital in Stockholm may be mentioned in this connection as a pilot scheme. It seems that Canada should keep abreast with these advances both by adapting foreign findings to her particular labour market, and by promoting a programme of her own in as-

sociation with physiologists and psychologists.

C) Time-study engineers, production specialists and personnel managers together with safety engineers and industrial staff can collaborate, combining their united knowledge of a particular industry, to prove that industrial equipment and methods can be adapted, sometimes with simple ingenious devices.

In conclusion, I would like to mention the statement of the famous British novelist John Galsworthy often quoted by Dr. Frank H. Krusen of the Mayo Clinic: "Restoration is at least as much a matter of spirit, as of body, and must have as its central truth: that body and spirit are inextricably joined. To heal the one without the other is impossible. . . Therefore, I would say: . . . 'Give him interest in his future. Light a star for him to fix his eyes on . . .'. A niche of usefulness and self-respect exists for every man however handicapped; but that niche must be found for him. To carry the process of restoration to a point short of this is to leave the cathedral without a spire. To restore him, and with him the future of our countries, that is the sacred work".

UNDERSTANDING HUMAN BEHAVIOR

(*Continued from page* 17)

almost always indicates that a person isn't getting along very well. The more he uses it to solve his conflicts, the worse off he is. Its use is always a symptom of inability to adjust.

There are many occasions when a person has good reason to think people don't like him or that they have it in for him. There are also times when such ideas are unwarranted. The healthy person usually can be enlightened about such attitudes. The person who can't be dissuaded from such ideas even when the accused person confronts him with the truth is reacting in an unhealthy fashion.

Everyone projects a little. There may be a grain of truth in our reasoning but we may be greatly exaggerating that grain of truth. The mechanism saves our self-esteem and the belief in our own ability. It couldn't be our fault that we couldn't measure up to certain requirements — it is someone else's fault. That's the way projection works — to make us feel better about oursèlves.

CONVERSION — A lot of ideas or wishes that come from the unconscious can't be expressed because the conscious part of our personality won't let them out. When it can't get out directly because the unconscious won't let it, it has to find an indirect way. Through the mechanism of conversion all the emotion attached to that first idea that couldn't get expressed is transferred to a substitute idea or behavior, which is very often a physical symptom.

For instance, if you have ever felt anxious and upset about something for a long time, you may develop a headache that you just can't explain. And what about the upset stomach you get when the boss chews you out about some work that wasn't done to suit him?

Conversion symptoms can become very serious. On the other hand, everybody develops them at times. When we are under stress, some physical distress should not surprise us. When we are faced with a difficult situation we react with everything we have — our mind, emotions, bones, muscles, organs, and even our skin.

SUMMARY

In the struggle between our personality and environment, our conscious mind helps us to compromise, through a set of devices called defense mechanisms.

If we use them properly, we can keep mentally healthy. If we misuse or overuse them, they can lead to mental illness.

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OCCUPATIONAL HEALTH REVIEW

"The program of the Occupational Health Division is concerned with service, research and education in the field of Occupational Health, and of Air Pollution in Canada.

The Division's activities include, environmental and clinical surveys, laboratory and consultative services; the promotion of teaching and research, and the publication of informative and educational material".

A QUARTERLY PUBLICATION